



ON Semiconductor®

# NC7SZ125 TinyLogic® UHS Buffer with Three-State Output

## Features

- Ultra-High Speed:  $t_{PD}$  2.6 ns (Typical) into 50 pF at 5 V  $V_{CC}$
- High Output Drive:  $\pm 24$  mA at 3 V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX Operated at 3.3 V  $V_{CC}$
- Power Down High-Impedance Inputs/Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23 and SC70 Packages

## Description

The NC7SZ125 is a single buffer with three-state output from ON Semiconductor's Ultra-High Speed (UHS) of TinyLogic®. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V range. The inputs and output are high impedance above ground when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 6 V independent of  $V_{CC}$  operating voltage. The output tolerates voltages above  $V_{CC}$  when in the 3-STATE condition.

## Ordering Information

Part Number	Top Mark	Package	Packing Method
NC7SZ125M5X	7Z25	5-Lead SOT23, JEDEC MO-178 1.6 mm	3000 Units on Tape & Reel
NC7SZ125P5X	Z25	5-Lead SC70, EIAJ SC-88a, 1.25 mm Wide	3000 Units on Tape & Reel
NC7SZ125L6X	DD	6-Lead MicroPak™, 1.00 mm Wide	5000 Units on Tape & Reel
NC7SZ125FHX	DD	6-Lead, MicroPak2, 1x1 mm Body, .35mm Pitch	5000 Units on Tape & Reel

NC7SZ125—TinyLogic® UHS Buffer with Three-State Output

## Connection Diagrams

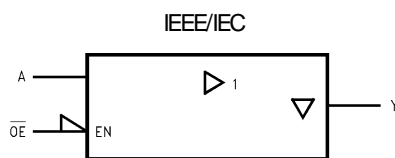


Figure 1. Logic Symbol

## Pin Configurations

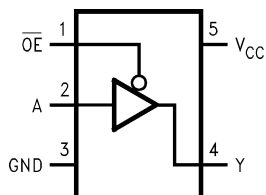


Figure 2. SC70 and SOT23 (Top View)

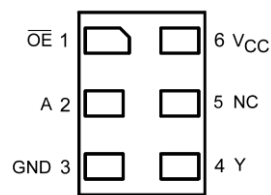


Figure 3. MicroPak™ (Top Through View)

## Pin Definitions

Pin # SC70 / SOT23	Pin # MicroPak	Name	Description
1	1	OE	Input
2	2	A	Input
3	3	GND	Ground
4	4	Y	Output
5	6	V <sub>CC</sub>	Supply Voltage
	5	NC	No Connect

## Function Table

Inputs		Output
/OE	In A	Out Y
L	L	L
L	H	H
H	X	Z

H = HIGH Logic Level

L = LOW Logic Level

X = HIGH or LOW Logic Level

Z = HIGH Impedance State

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
$V_{CC}$	Supply Voltage	-0.5	6.0	V
$V_{IN}$	DC Input Voltage	-0.5	6.0	V
$V_{OUT}$	DC Output Voltage	-0.5	6.0	V
$I_{IK}$	DC Input Diode Current	$V_{IN} < -0.5\text{ V}$	-50	mA
		$V_{IN} > 6.0\text{ V}$	+20	
$I_{OK}$	DC Output Diode Current	$V_{OUT} < -0.5\text{ V}$	-50	mA
		$V_{OUT} > 6\text{ V}, V_{CC}=\text{GND}$	+20	
$I_{OUT}$	DC Output Current		$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current		$\pm 50$	mA
$T_{STG}$	Storage Temperature Range	-65	+150	$^{\circ}\text{C}$
$T_J$	Junction Temperature Under Bias		+150	$^{\circ}\text{C}$
$T_L$	Junction Lead Temperature (Soldering, 10 Seconds)		+260	$^{\circ}\text{C}$
$P_D$	Power Dissipation at +85 $^{\circ}\text{C}$	SOT-23	200	mW
		SC70-5	150	
		MicroPak-6	130	
		MicroPak2-6	120	
ESD	Human Body Model, JESD22-A114		4000	V
	Charged Device Model, JESD22-C101		2000	

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. ON Semiconductor does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Conditions	Min.	Max.	Unit
$V_{CC}$	Supply Voltage Operating		1.65	5.50	V
	Supply Voltage Data Retention		1.50	5.50	
$V_{IN}$	Input Voltage		0	5.5	V
$V_{OUT}$	Output Voltage	Active State	0	$V_{CC}$	V
		Three-State	0	5.5	
$T_A$	Operating Temperature		-40	+85	$^{\circ}\text{C}$
$t_r, t_f$	Input Rise and Fall Times	$V_{CC}$ at 1.8 V, 2.5 V $\pm 0.2\text{ V}$	0	20	ns/V
		$V_{CC}$ at 3.3 V $\pm 0.3\text{ V}$	0	10	
		$V_{CC}$ at 5.0 V $\pm 0.5\text{ V}$	0	5	
$\theta_{JA}$	Thermal Resistance	SOT-23		300	$^{\circ}\text{C}/\text{W}$

		SC70-5		425	
		MicroPak-6		500	
		MicroPak2-6		560	

**Note:**

1. Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

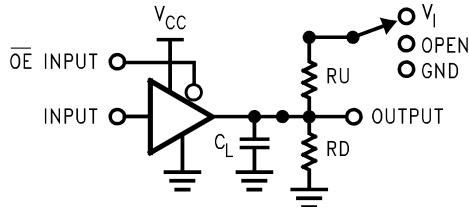
Symbol	Parameter	V <sub>CC</sub>	Conditions	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	HIGH Level Input Voltage	1.65 to 1.95		0.75V <sub>CC</sub>			0.75V <sub>CC</sub>		V
		2.30 to 5.50		0.70V <sub>CC</sub>			0.70V <sub>CC</sub>		
V <sub>IL</sub>	LOW Level Input Voltage	1.65 to 1.95				0.25V <sub>CC</sub>		0.25V <sub>CC</sub>	V
		2.30 to 5.50				0.30V <sub>CC</sub>		0.30V <sub>CC</sub>	
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> =V <sub>IH</sub> , I <sub>OH</sub> =-100 μA	1.55	1.65		1.55		V
		1.80		1.70	1.80		1.70		
		2.30		2.20	2.30		2.20		
		3.00		2.90	3.00		2.90		
		4.50		4.40	4.50		4.40		
		1.65	I <sub>OH</sub> =-4 mA	1.29	1.52		1.29		
		2.30	I <sub>OH</sub> =-8 mA	1.90	2.15		1.90		
		3.00	I <sub>OH</sub> =-16 mA	2.40	2.80		2.40		
		3.00	I <sub>OH</sub> =-24 mA	2.30	2.68		2.30		
		4.50	I <sub>OH</sub> =-32 mA	3.80	4.20		3.80		
V <sub>OL</sub>	LOW Level Output Voltage	1.65	V <sub>IN</sub> =V <sub>IL</sub> , I <sub>OL</sub> =100 μA		0.00	0.10		0.00	V
		1.80			0.00	0.10		0.10	
		2.30			0.00	0.10		0.10	
		3.00			0.00	0.10		0.10	
		4.50			0.00	0.10		0.10	
		1.65	I <sub>OL</sub> =4 mA		0.80	0.24		0.24	
		2.30	I <sub>OL</sub> =8 mA		0.10	0.30		0.30	
		3.00	I <sub>OL</sub> =16 mA		0.15	0.40		0.40	
		3.00	I <sub>OL</sub> =24 mA		0.22	0.55		0.55	
		4.50	I <sub>OL</sub> =32 mA		0.22	0.55		0.55	
I <sub>IN</sub>	Input Leakage Current	0 to 5.5	0 ≥ V <sub>IN</sub> ≥ 5.5 V			±1		±10	μA
I <sub>OZ</sub>	3-STATE Output Leakage	0 to 5.5	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> 0 ≥ V <sub>O</sub> ≥ 5.5 V			±1		±10	μA
I <sub>OFF</sub>	Power Off Leakage Current	0	V <sub>IN</sub> or V <sub>OUT</sub> =5.5 V			1		10	μA
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> =5.5 V, GND			2		20	μA

### AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub>	Conditions	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay	1.65	C <sub>L</sub> =15 pF, R <sub>D</sub> =1 MΩ S <sub>1</sub> =OPEN	2.0	6.4	13.2	2.0	13.8	ns	Figure 4 Figure 6
		1.80		2.0	5.3	11.0	2.0	11.5		
		2.50 ±0.20		0.8	3.4	7.5	0.8	8.0		
		3.30 ±0.30		0.5	2.5	5.2	0.5	5.5		
		5.00 ±0.50		0.5	2.1	4.5	0.5	4.8		
		3.30 ±0.30		1.5	3.2	5.7	1.5	6.0		
t <sub>PZL</sub> , t <sub>PZH</sub>	Output Enable Time	1.65	C <sub>L</sub> =50 pF, R <sub>D</sub> =500 Ω R <sub>U</sub> =500 Ω S <sub>1</sub> =GND for t <sub>PZH</sub> S <sub>1</sub> =V <sub>IN</sub> for t <sub>PZL</sub> V <sub>IN</sub> =2•V <sub>CC</sub>	2.0	8.4	15.0	2.0	15.6	ns	Figure 4 Figure 6
		1.80		2.0	7.0	12.5	2.0	13.0		
		2.50 ±0.20		1.5	4.6	8.5	1.5	9.0		
		3.30 ±0.30		1.5	3.5	6.2	1.5	6.5		
		5.00 ±0.50		0.8	2.8	5.5	0.8	5.8		
		3.30 ±0.30		1.5	3.5	8.0	1.5	8.5		
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Output Disable Time	1.65	C <sub>L</sub> =50 pF, R <sub>D</sub> =500 Ω R <sub>U</sub> =500 Ω S <sub>1</sub> =GND for t <sub>PHZ</sub> S <sub>1</sub> =V <sub>IN</sub> for t <sub>PLZ</sub> V <sub>IN</sub> =2•V <sub>CC</sub>	2.0	6.5	13.2	2.0	14.5	ns	Figure 4 Figure 6
		1.80		2.0	5.4	11.0	2.0	12.0		
		2.50 ±0.20		1.5	3.5	8.0	1.5	8.5		
		3.30 ±0.30		1.0	2.8	5.7	1.0	6.0		
		5.00 ±0.50		0.5	2.1	4.7	0.5	5.0		
		3.30 ±0.30		1.0	2.8	5.7	1.0	6.0		
C <sub>IN</sub>	Input Capacitance	0.00			4			pF		
C <sub>OUT</sub>	Output Capacitance	0.00			8					
C <sub>PD</sub>	Power Dissipation Capacitance <sup>(2)</sup>	3.30			17			pF	Figure 5	
		5.00			24					

**Note:**

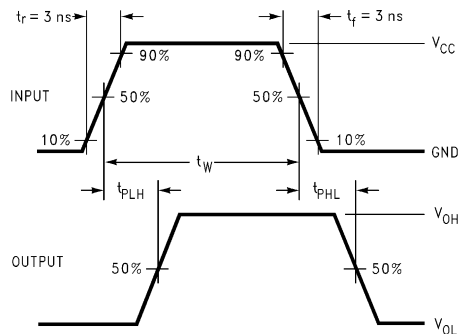
- C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub>=(C<sub>PD</sub>)(V<sub>CC</sub>)(f<sub>IN</sub>)+(I<sub>CC</sub>static).

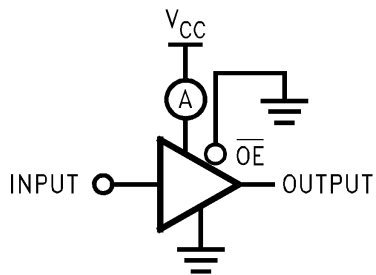


**Note:**

- C<sub>L</sub> includes load and stray capacitance. Input PRR=1.0 MHz, t<sub>W</sub>=500 ns.

**Figure 4. AC Test Circuit**

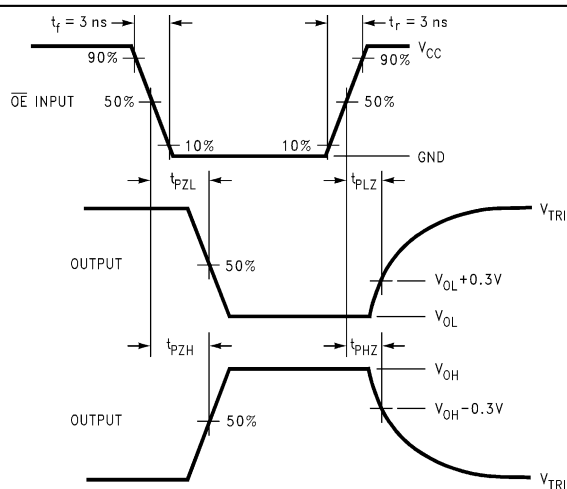




**Note:**

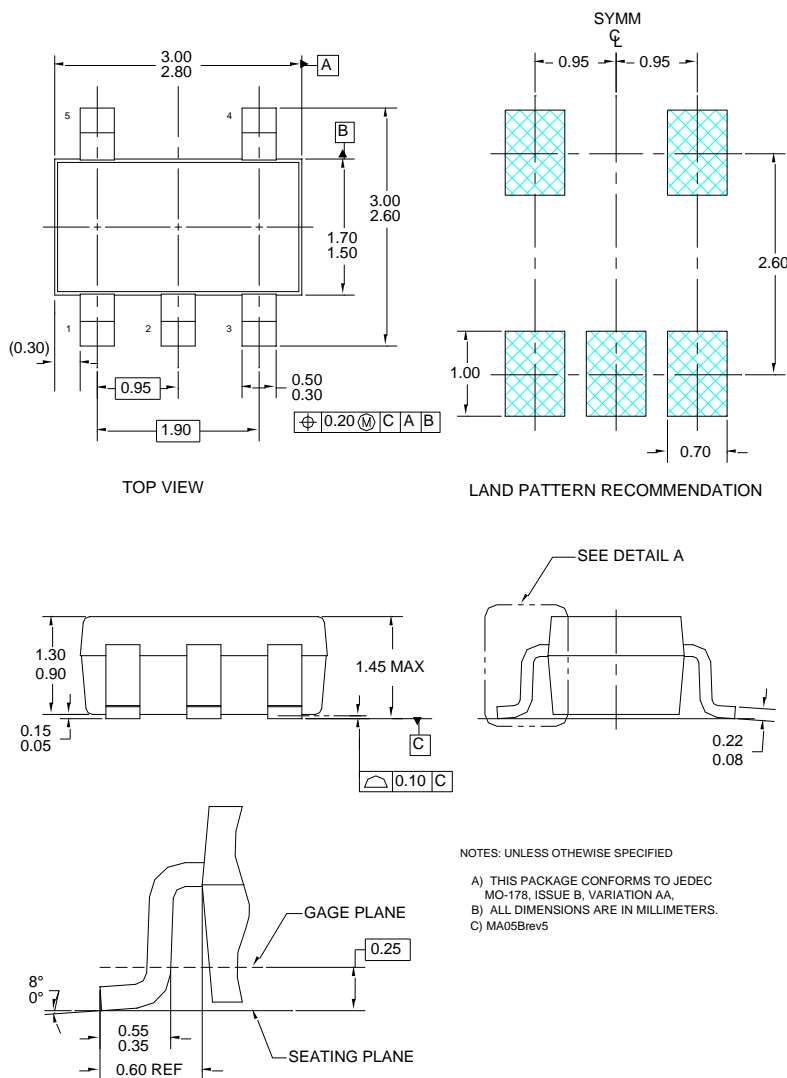
- 4. Input=AC Waveform;  $t_r=t_f=1.8$  ns;  
 PRR=10 MHz; Duty Cycle=50%.

**Figure 5.  $I_{CCD}$  Test Circuit**



**Figure 6. AC Waveforms**

## Physical Dimensions



**Figure 7. 5-Lead SOT23, JEDEC MO-178 1.6 mm**

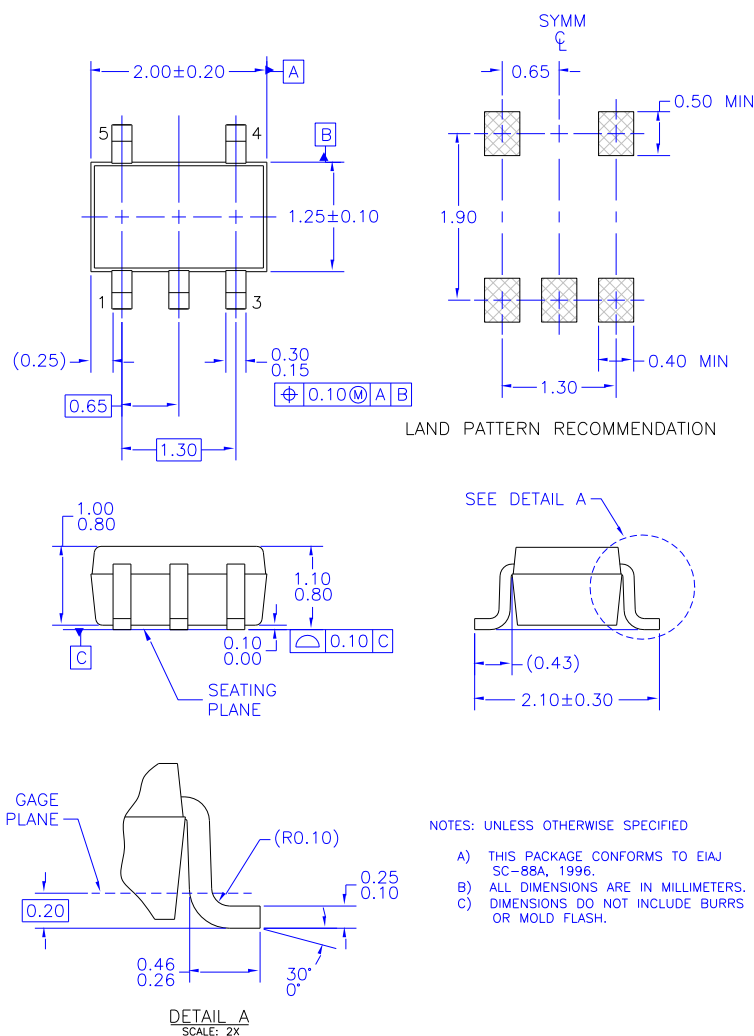
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## Tape and Reel Specifications

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
M5X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed



## Physical Dimensions



MAA05AREV5

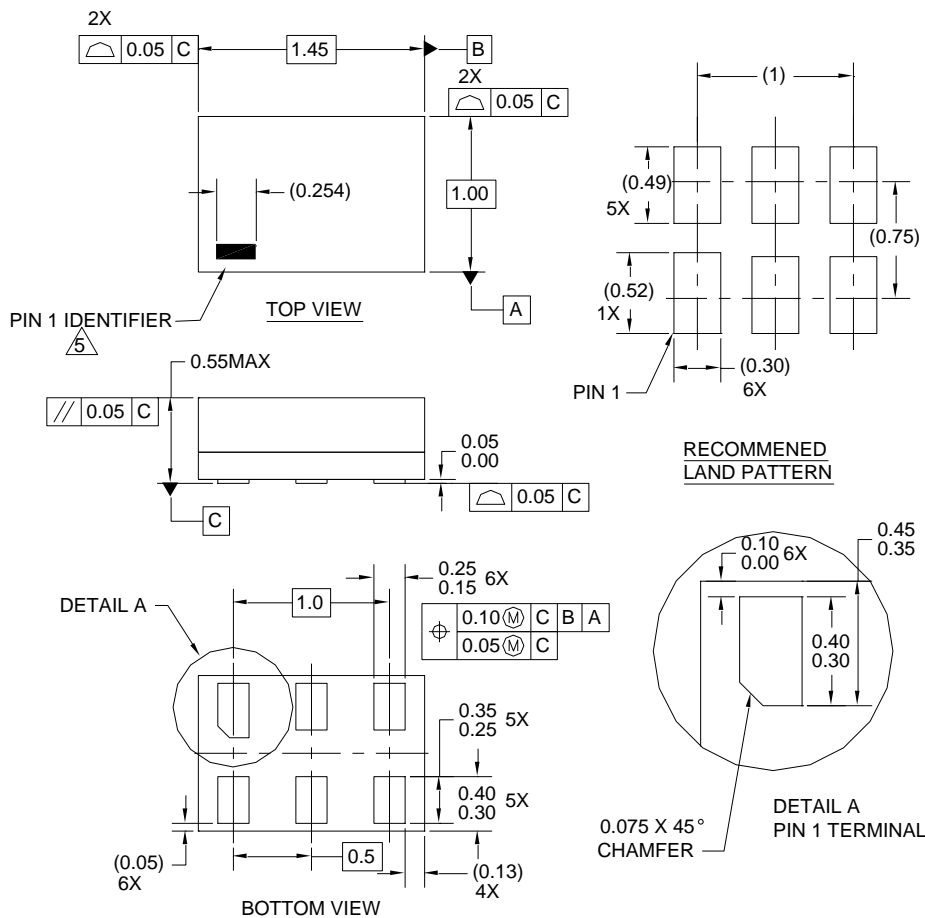
**Figure 8. 5-Lead, SC70, EAJ SC-88a, 1.25 mm Wide**

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## Tape and Reel Specifications

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
P5X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

## Physical Dimensions



**Notes:**

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994
4. FILENAME AND REVISION: MAC06AREV4
5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

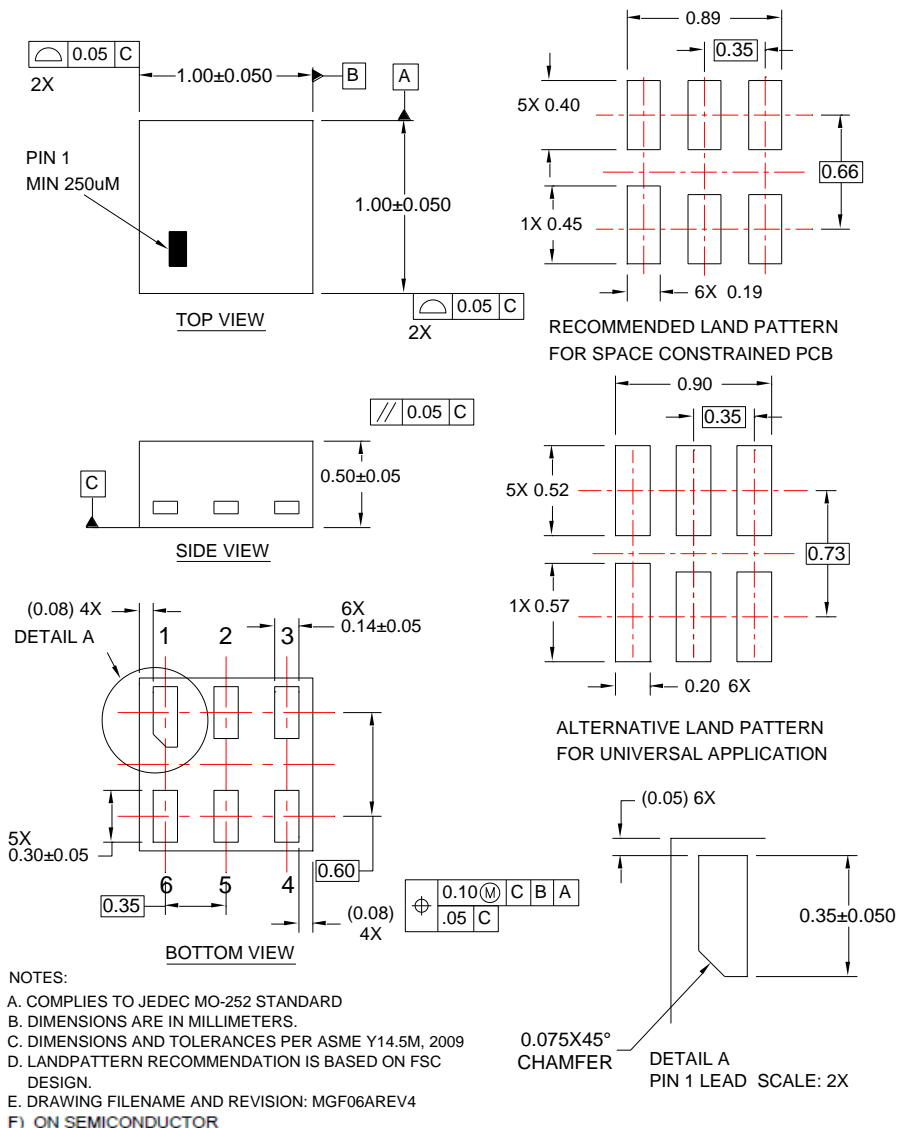
**Figure 9. 6-Lead, MicroPak™, 1.0 mm Wide**

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L6X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

## Physical Dimensions



**Figure 10. 6-Lead, MicroPak2, 1x1 mm Body, .35 mm Pitch**

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## Tape and Reel Specifications

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FHX	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

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